



Carbon Emissions Task Force

Economic Effects of Carbon Pricing in Washington State

Presented by
Forecasting and Research Division, OFM

Revised September 23, 2014



Analysis Objectives

- To support the Carbon Emissions Reduction Taskforce evaluate potential economic impacts of a market-based carbon dioxide emissions pricing system. This analysis was done in consultation with the Governor's office consultant team at ICF. Economic analysis was carried out by the forecasting and research team at the Washington State Office of Financial Management..
- The key analysis questions:
 - What effects will a market-based policy to reduce carbon and other emissions have on the economy?
 - What sectors will experience job growth or loss?
 - What transition effects will result due to the switch from more carbon intensive processes to a greener economy?
 - How might the revenues from a carbon price policy be best used to create jobs or income or both?



Approach

- Costs
- Revenue Recycling
- Indicators
 - Level of emission reductions limits by 2020 and 2035
 - Price changes for energy and fuel sectors
 - Changes in Washington's job market
 - Changes in Washington State Gross Domestic Product
 - Changes in Washington State personal income

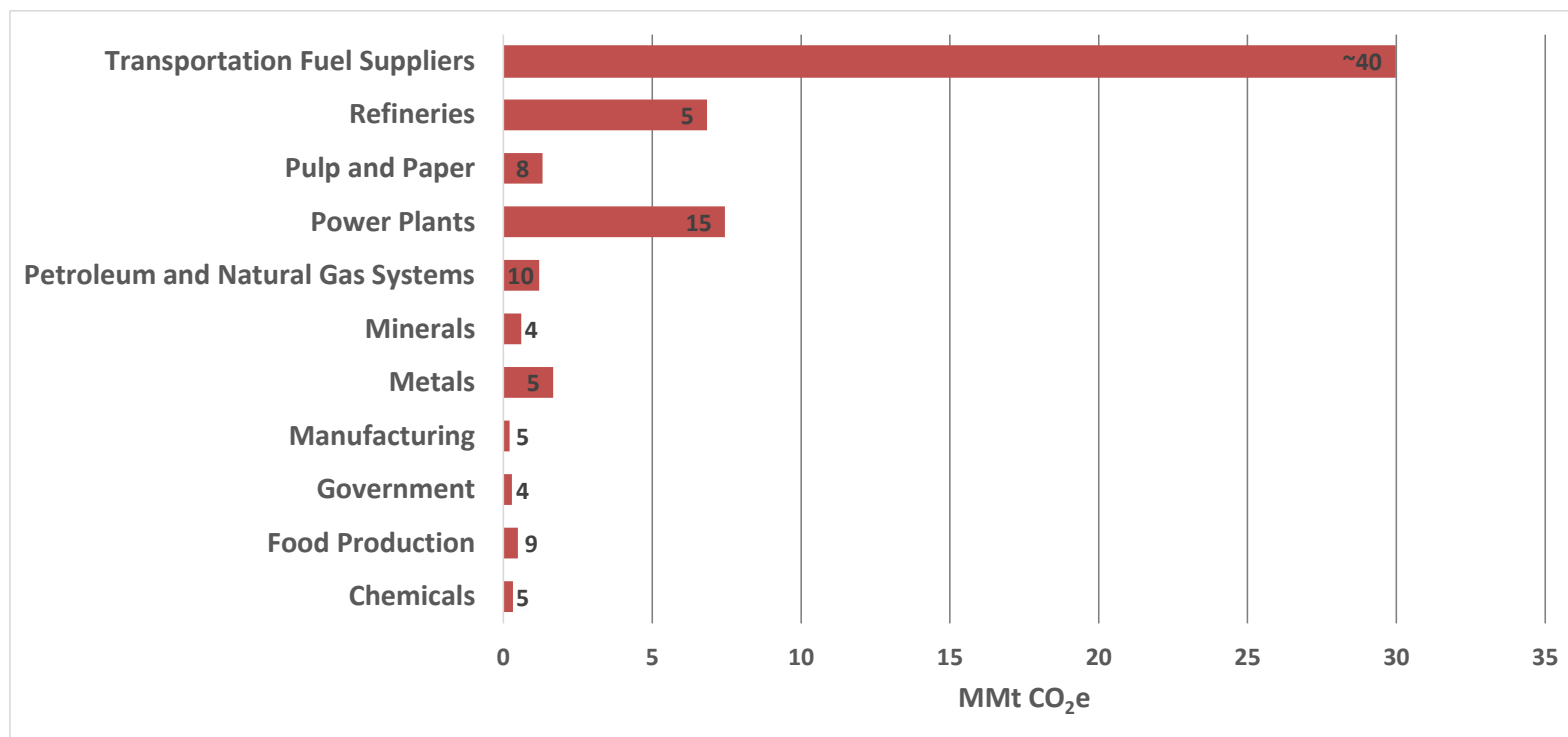


Figure 1. 2011 GHG Emissions from Sectors Likely to be Regulated Under a Washington Cap-and-Trade Program.

Covered sectors with average emissions (2010 – 2013) that exceed 25,000 MTCO₂e/year. Number of individual facilities in each sector shown inside each bar. The number of transportation fuel suppliers is approximate.

Suppliers of marine, rail, and aviation fuels and heating oil are not included (or are very spotty). For individual facility information see: <http://ghgdata.epa.gov>

Source: Washington Department of Ecology.

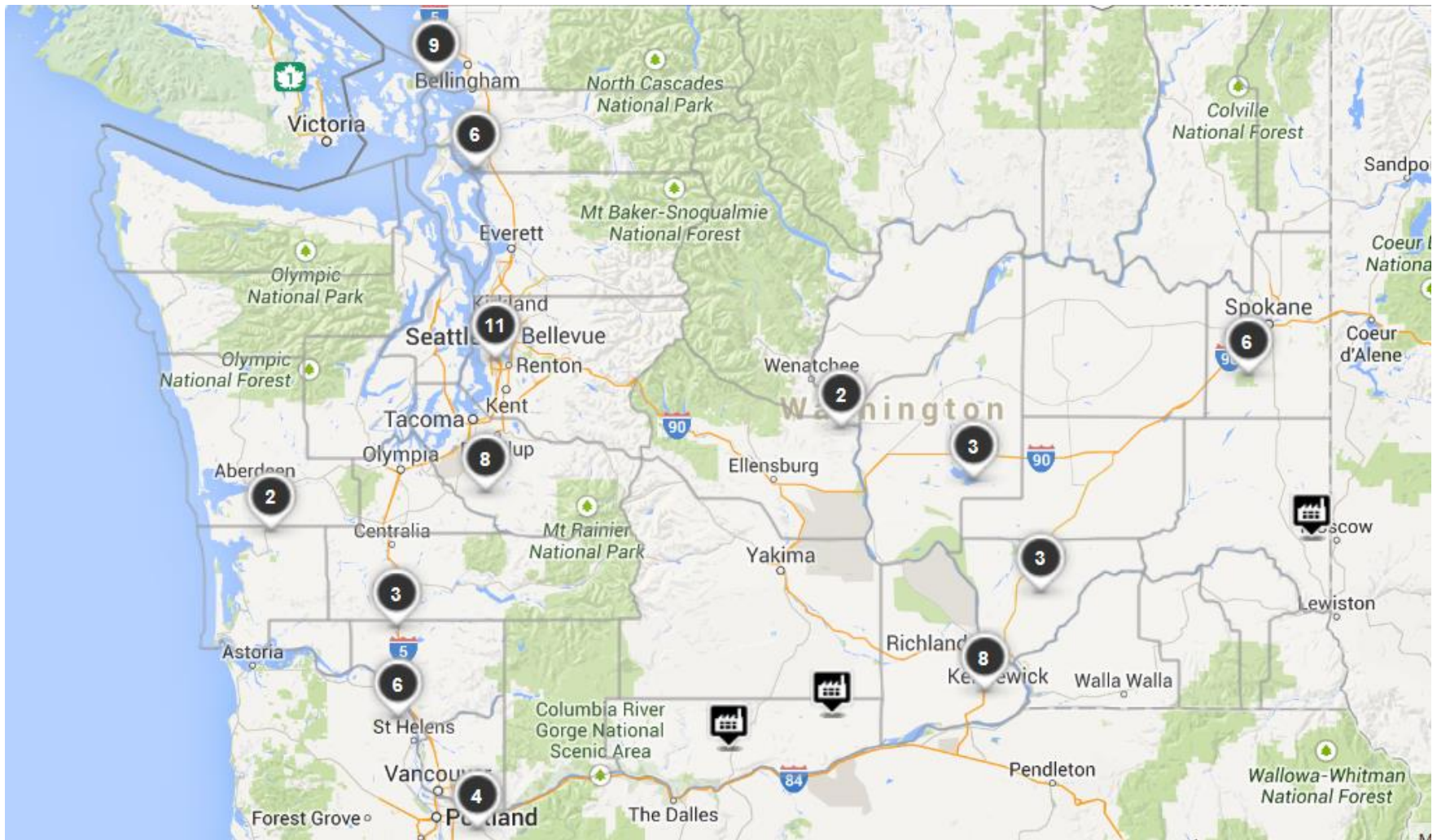


Figure 2. Location of Stationary Facilities in Washington State Likely to be Regulated Under a Cap-and-Trade Program. Fuel suppliers not included in figure. For county-level information on precise facility locations see: <http://ghgdata.epa.gov> Number of facilities are approximate and may not match data provided in Figure 1.



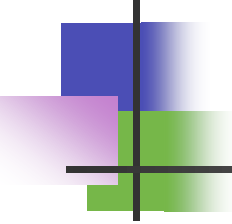
Assumptions & Limitations

- 100% auction off all allowances
- No trading of allowances, offsets or other opportunities to reduce compliance costs
- No additional innovation assumed following price increases
- Additional complementary policies excluded
- Additional emissions reductions from spending excluded



Key Findings

- Economic: The net effect of both scenarios on Washington state jobs, GDP and personal income is slightly different from baseline.
- Revenue recycling: Industry effects shown are partially a function of the revenue recycling assumptions used.
- Fuel and Energy Prices: Increasing but at different rates; natural gas the most, electricity the least.
- Emissions Low Price Scenario: Under the low price scenario we do not get to the 2020 or 2035 emissions reduction limits.
- Emissions High Price Scenario: Under the high price scenario we hit both limits because the carbon price was chosen to meet the limits.



Study Methodology

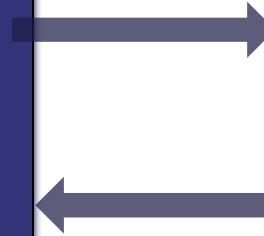
Integrated two models

CTAM Model - Microsoft Excel-based forecasts:

- State-level CO₂ emissions
- Potential revenues under different levels of carbon price
- Uses projections from 2014 Annual Energy Outlook of EIA
- Uses parameter relationships between heat, fuel and carbon to forecast emissions
- Relates the energy data to fiscal concepts such as carbon tax, consumer response to changes in energy prices

REMI Tax PI Model

- Dynamic forecasting & policy analysis tool
- Contains 160 industries
- Demonstrates economic changes over time
- Analyzes economic growth over time against reference case
 - GDP
 - Total employment by industry
 - Personal Income
 - Output by industry





Scenarios

- Two price scenarios were considered with blended revenue recycling to offset costs to consumers and help businesses and industries transition from high carbon energy sources to low carbon energy sources.
- The scenarios and results presented are illustrative and provide initial orders of magnitude and direction of change.
- Industry sector shifts embedded in this analysis give examples of what the models can do.
- Used for guiding continued analysis and evolving carbon policy.

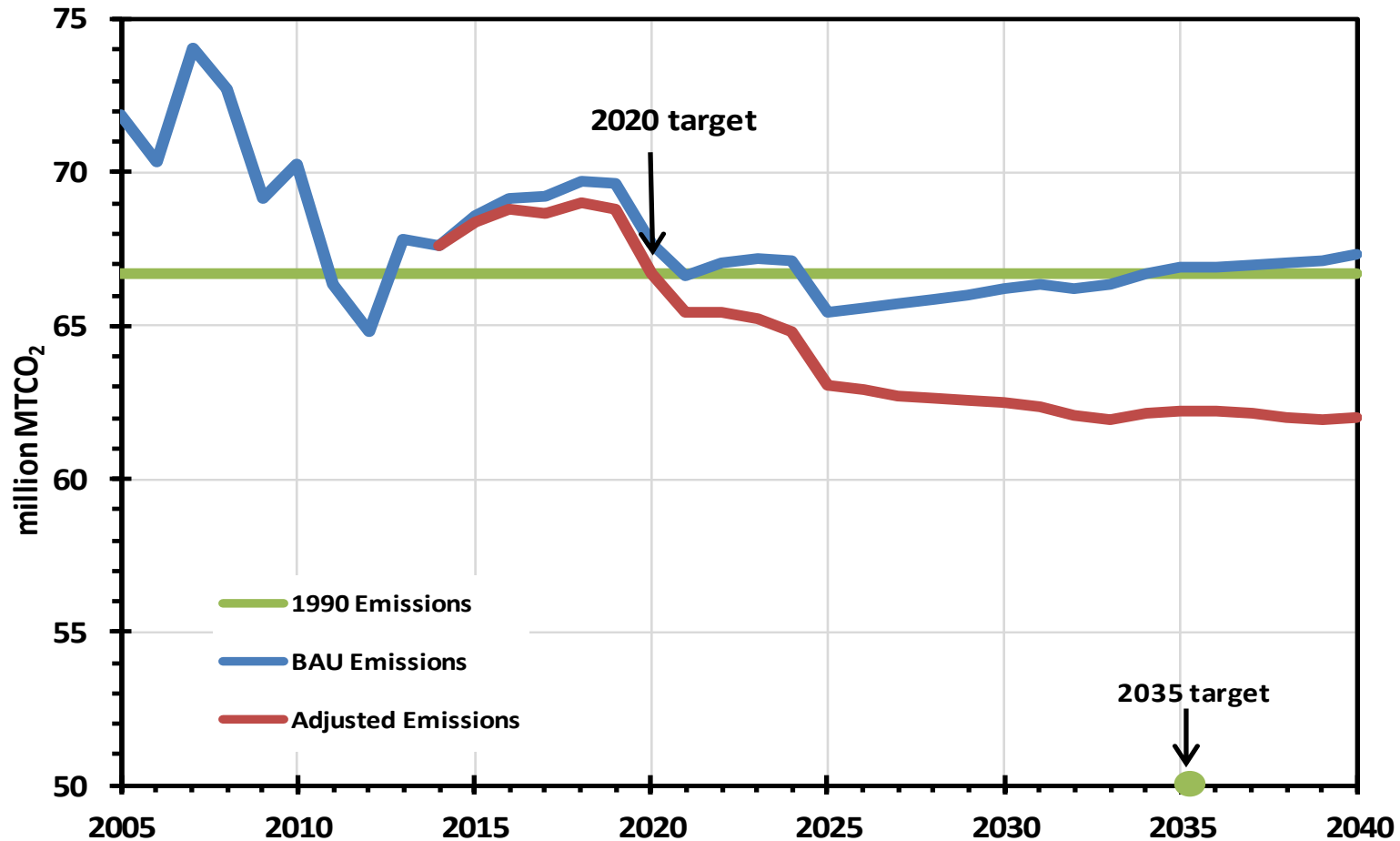


A Revenue Recycling Model Example

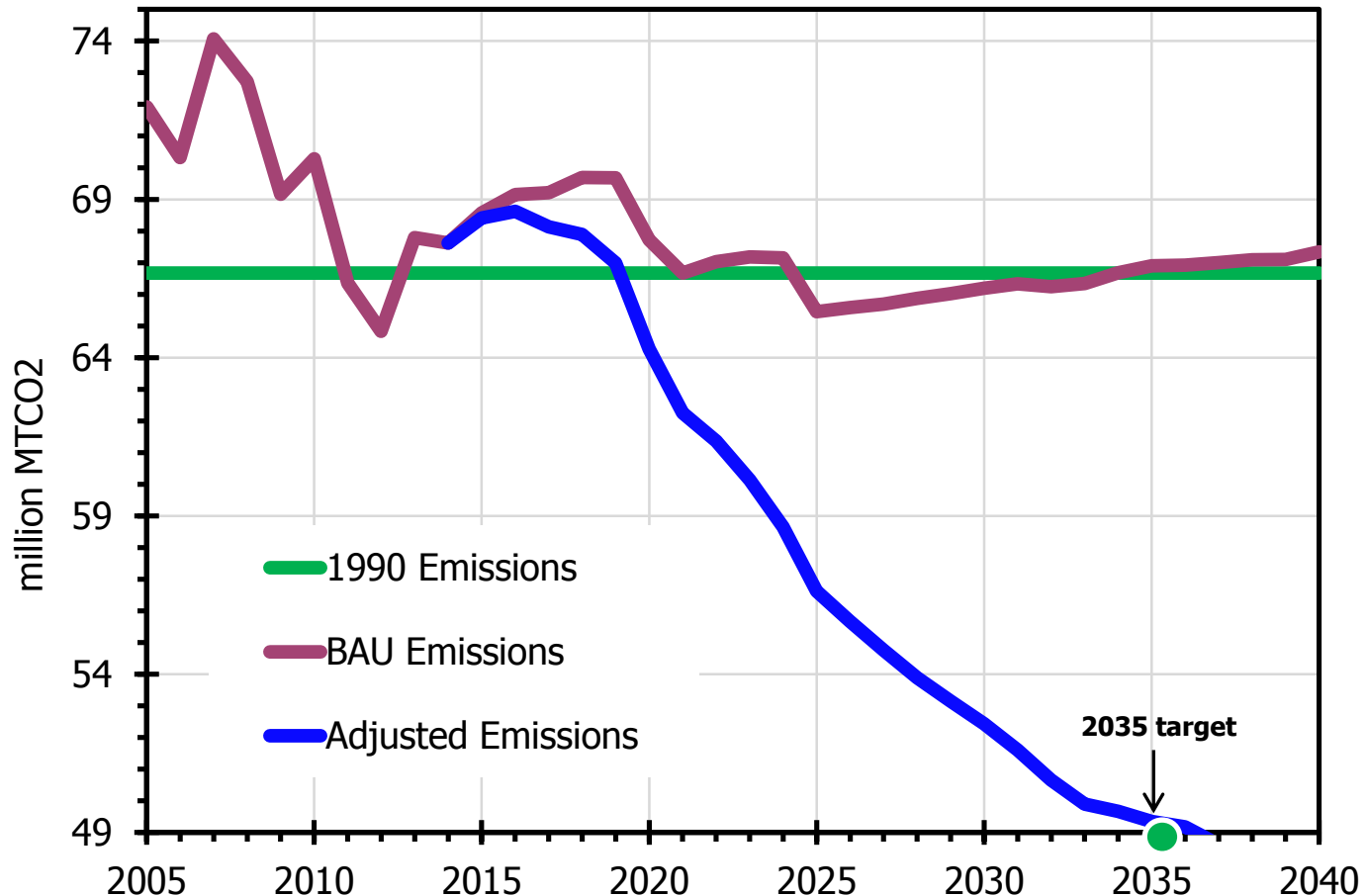
Two carbon tax price scenarios were used:

- Higher price model
 - \$12 per metric ton first year, increasing \$8 per year thereafter
- Lower price model
 - \$12 per metric ton first year, increasing \$0.60 per year through 2020 and \$2 per year thereafter

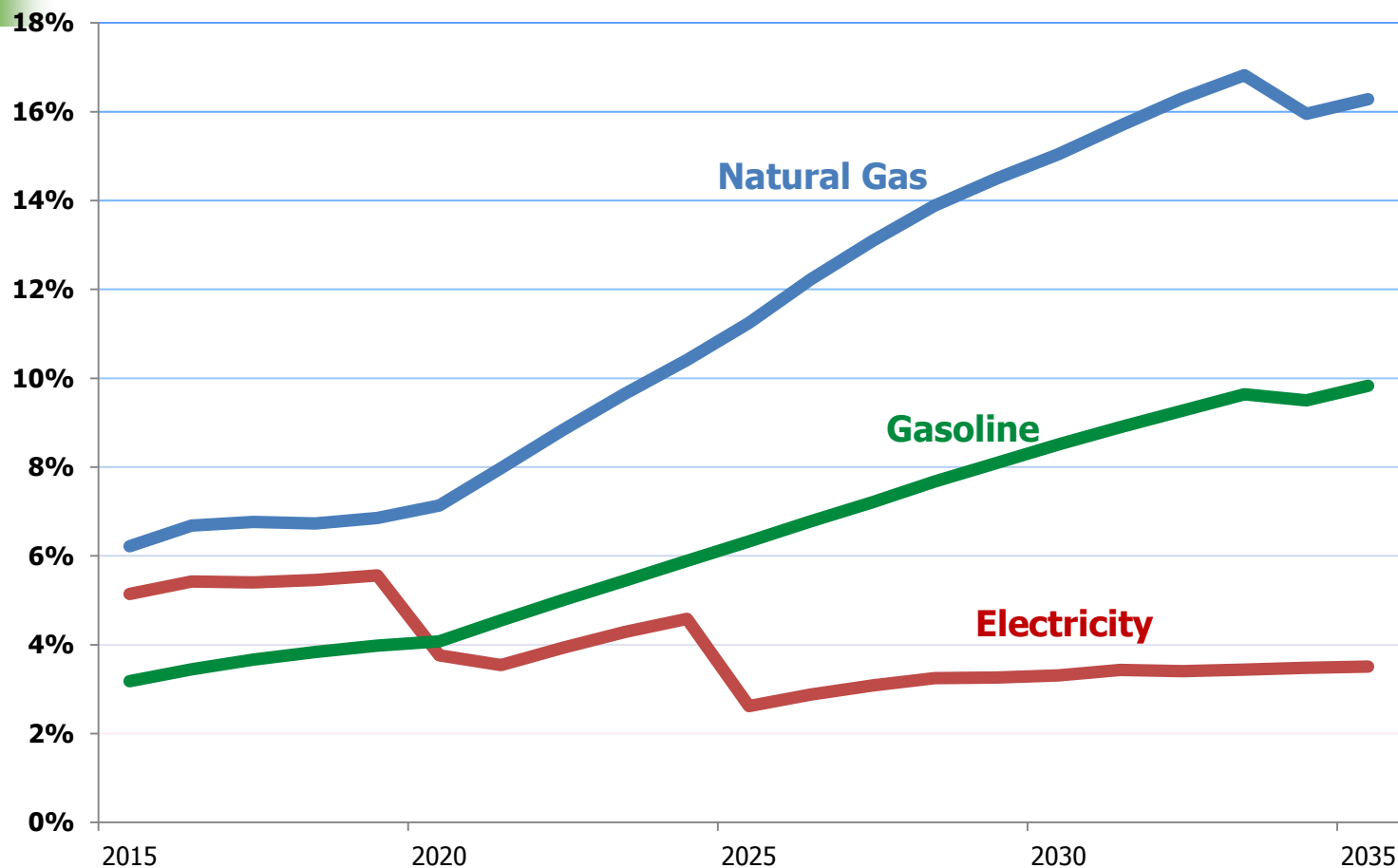
Emissions Compared to Business as Usual in relation to 2020 & 2035 Limits: Low Price Scenario



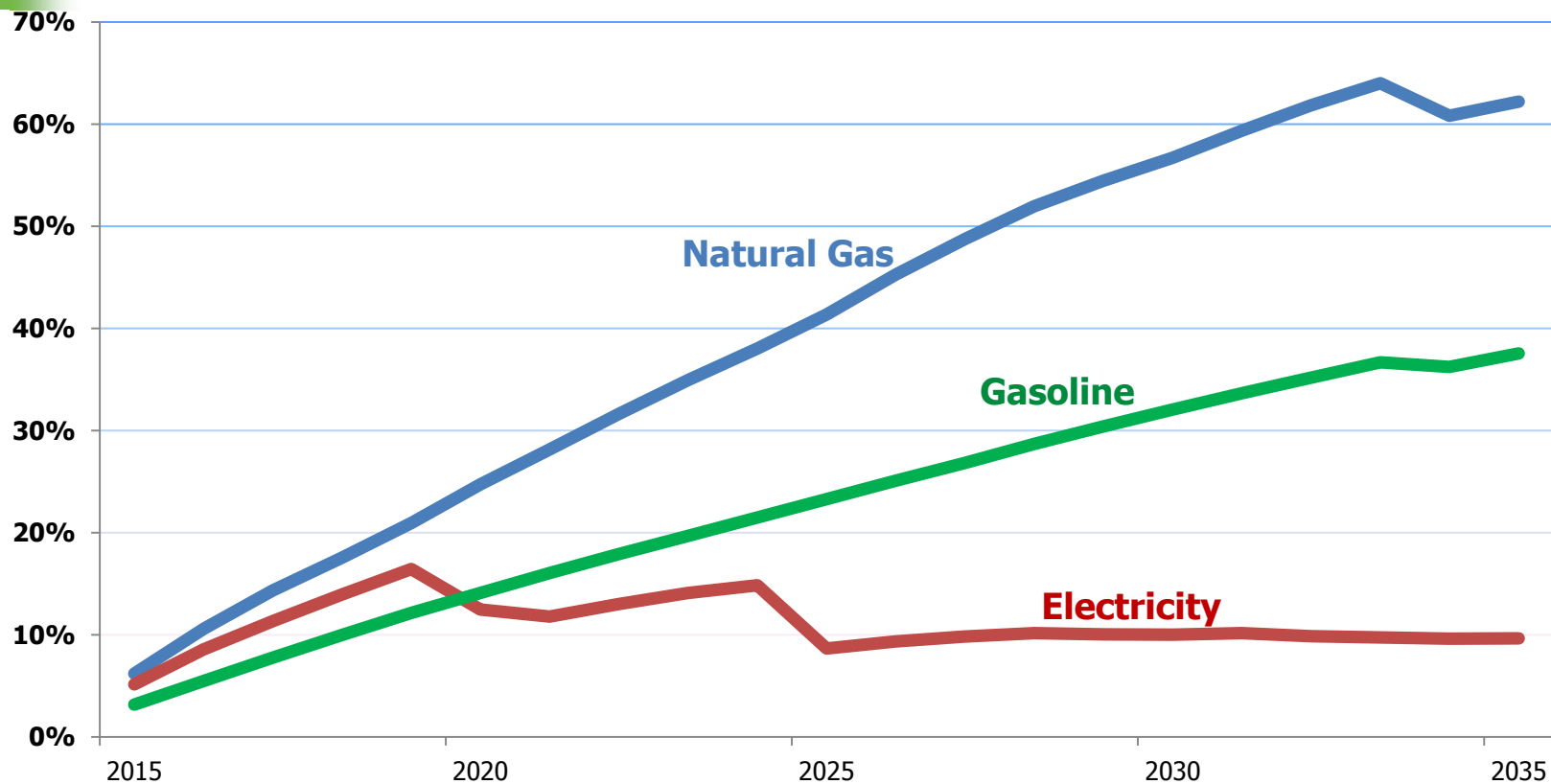
Emissions Compared to Business as Usual in relation to 2020 & 2035 Limits: High Price Scenario



Fuel and Energy Price Changes, Low Carbon Price Case



Fuel and Energy Price Changes High Price Case





Carbon Price Revenues

	2016	2020	2035
Sector	Millions \$	Millions \$	Millions \$
Revenue, Low Price Case	\$737	\$843	\$2,299
Revenue, High Price Case	\$1,165	\$2,794	\$6,575

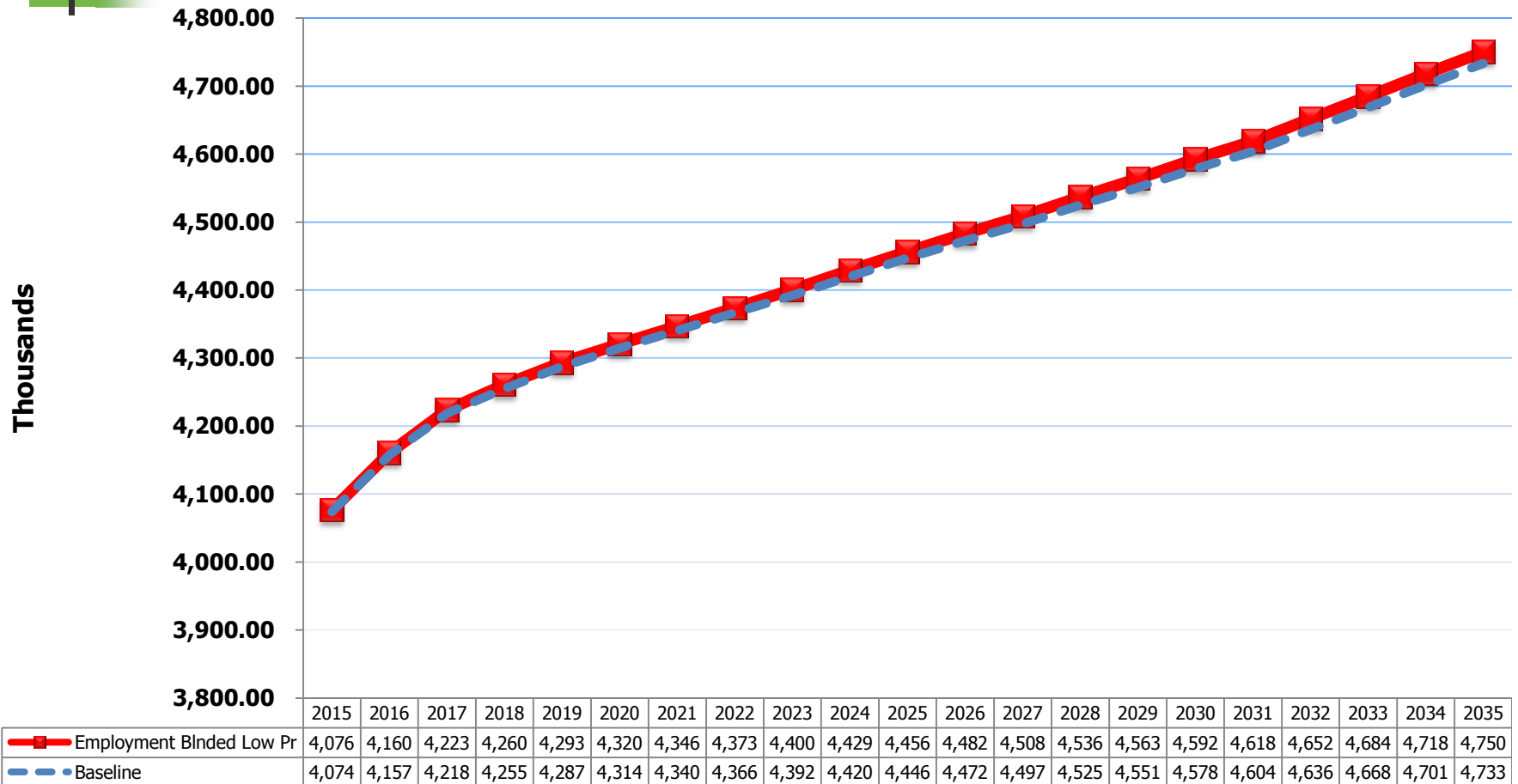


A revenue recycling model example

Carbon tax revenues were apportioned as follows:

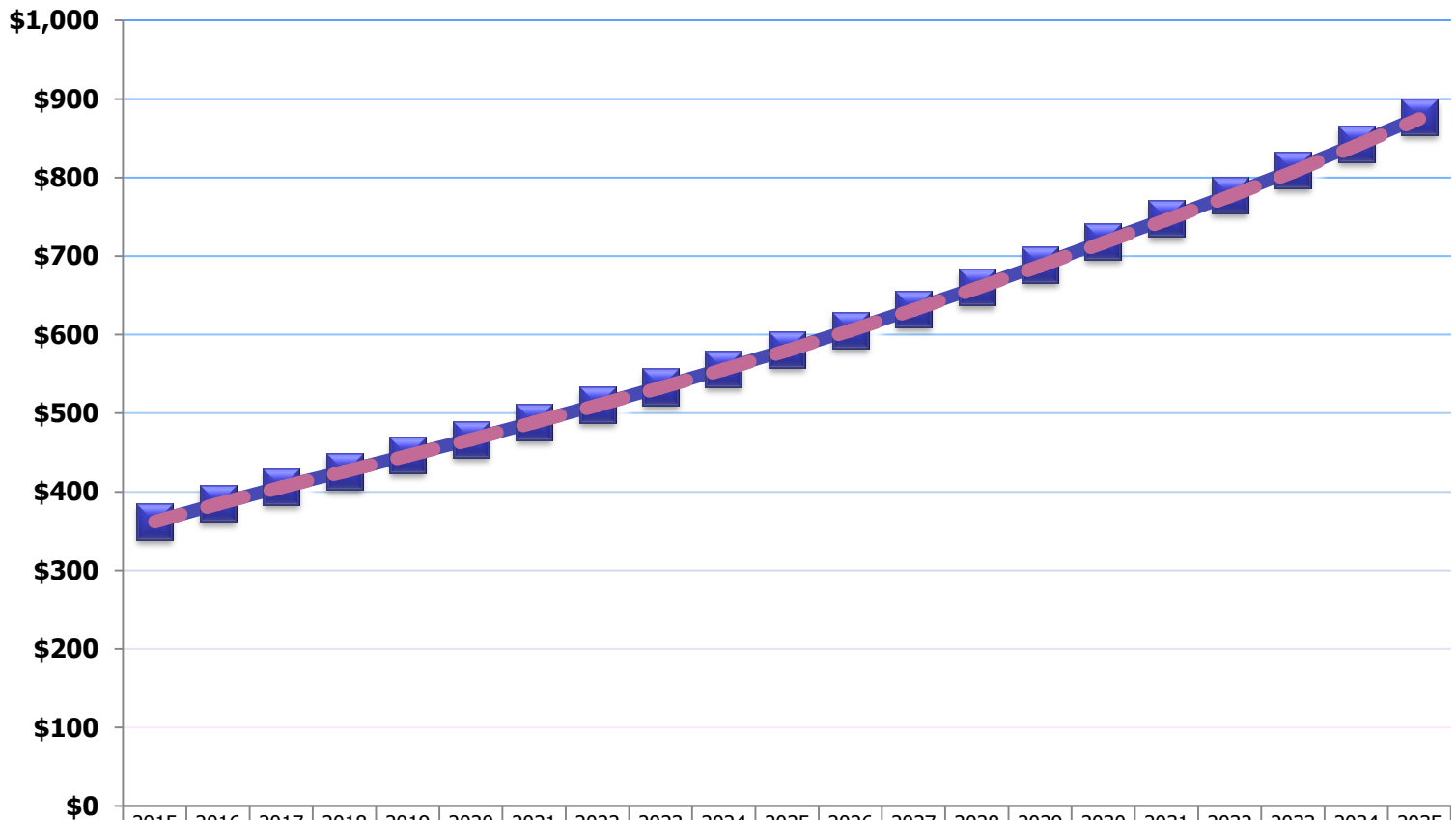
- 30% to Working Families Tax Credit
- 15% B&O tax cut to trade exposed industries
- 40% B&O tax cut to construction sector
- 10% B&O tax cut to electric power generation, transmission, and distribution
- 5% to state General Fund

Washington Employment, Blended Allocation Small Price Increase



Washington Nominal Personal Income, Blended Allocation Small Price Increase

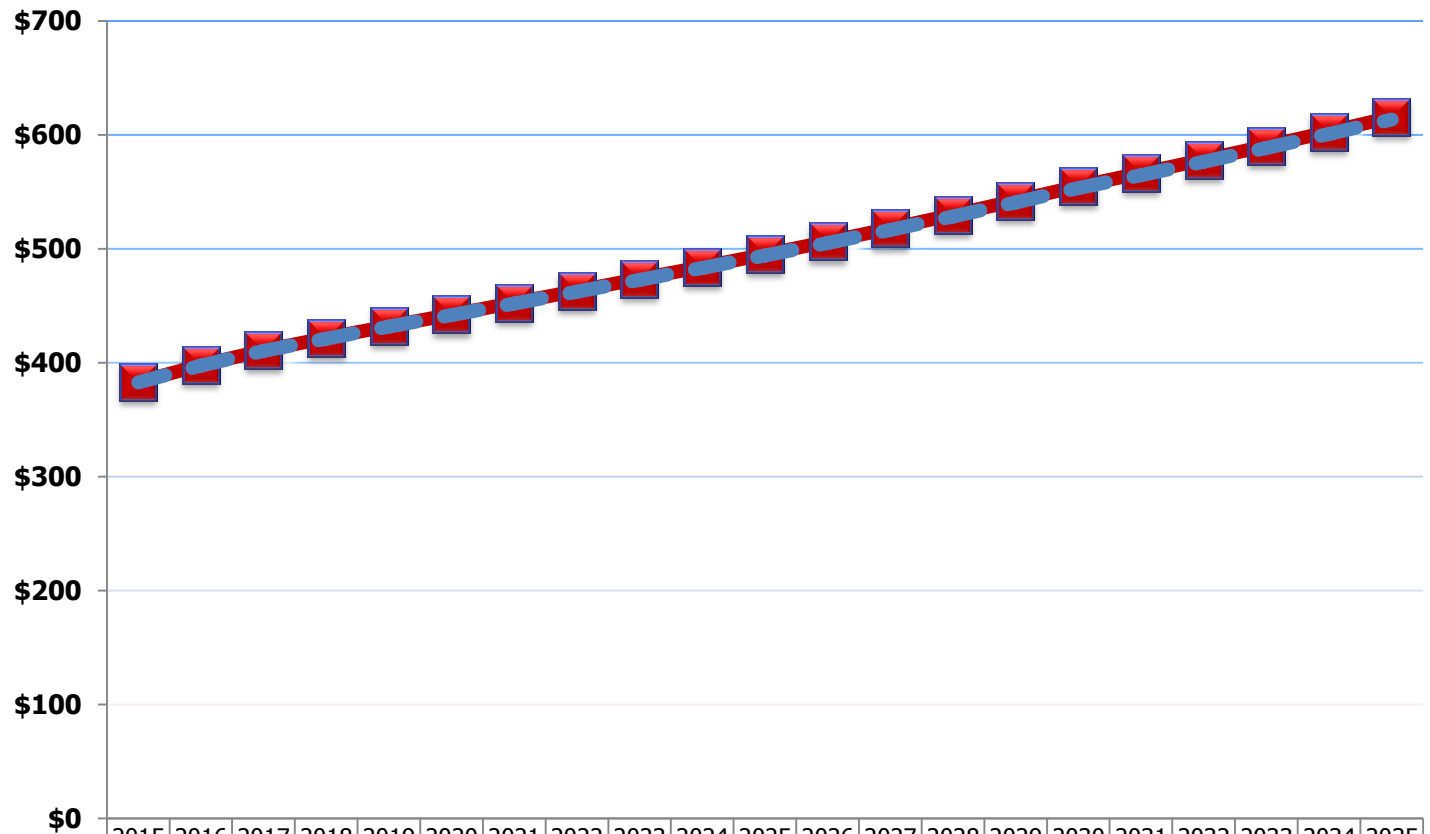
Billions of current dollars



Personal Inc Blnd Low Pr	362.0	384.7	406.1	426.1	446.2	466.9	488.6	510.5	533.2	556.5	580.5	605.9	632.5	660.0	688.8	718.4	747.4	777.5	809.1	842.5	876.9
Baseline	361.9	384.6	405.9	425.7	445.8	466.4	488.1	510.0	532.5	555.8	579.7	605.0	631.4	658.9	687.5	716.9	745.8	775.7	807.1	840.4	874.7

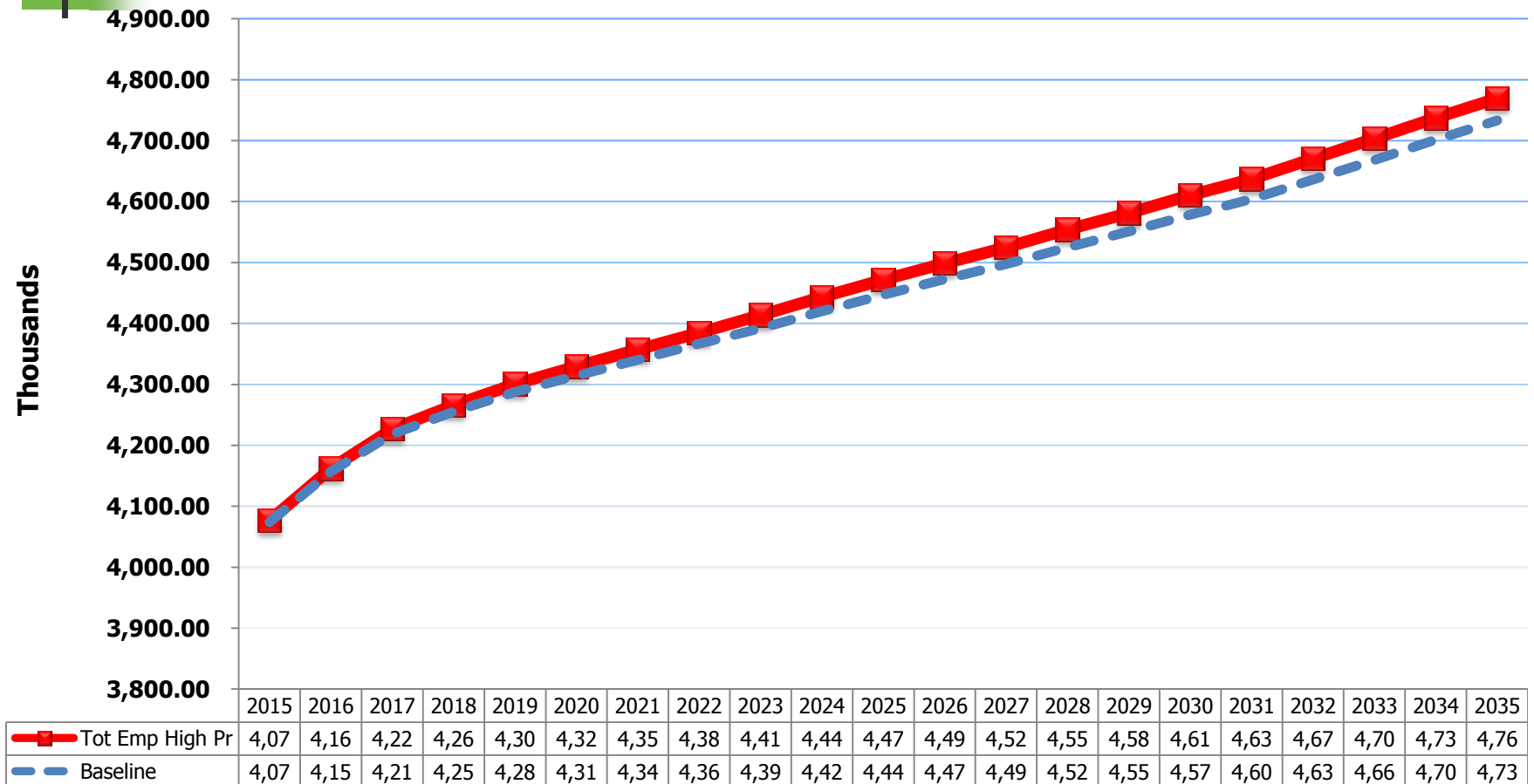
Washington Real GDP, Blended Small Price Increase

Billions of fixed 2009 dollars

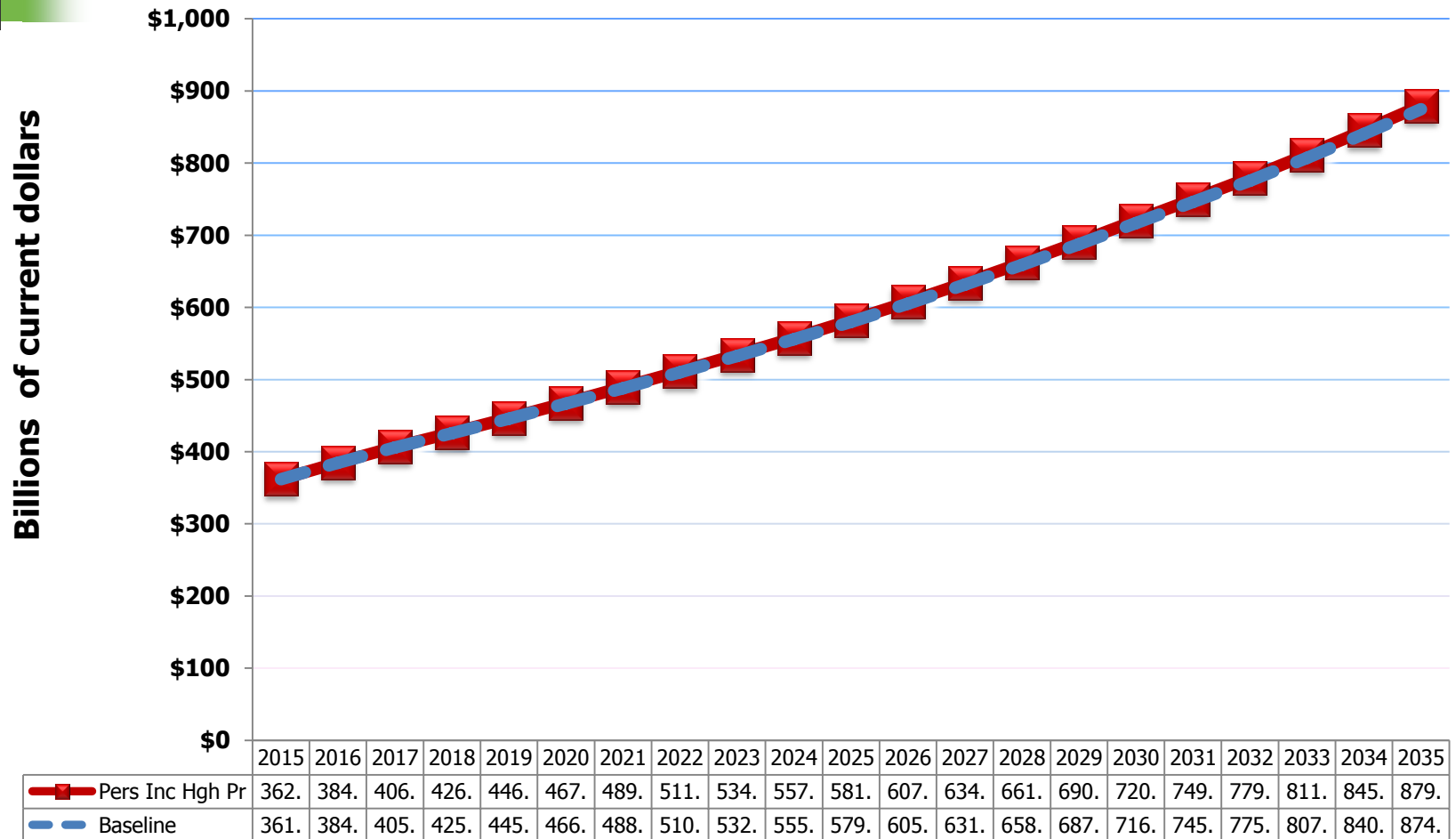


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
■ GDP Blended Low Pr	382.	397.	410.	421.	432.	442.	452.	462.	473.	484.	495.	506.	517.	529.	542.	554.	566.	578.	590.	602.	615.
■ Baseline	382.	397.	410.	421.	431.	441.	452.	462.	472.	483.	494.	505.	516.	528.	540.	553.	564.	576.	588.	600.	613.

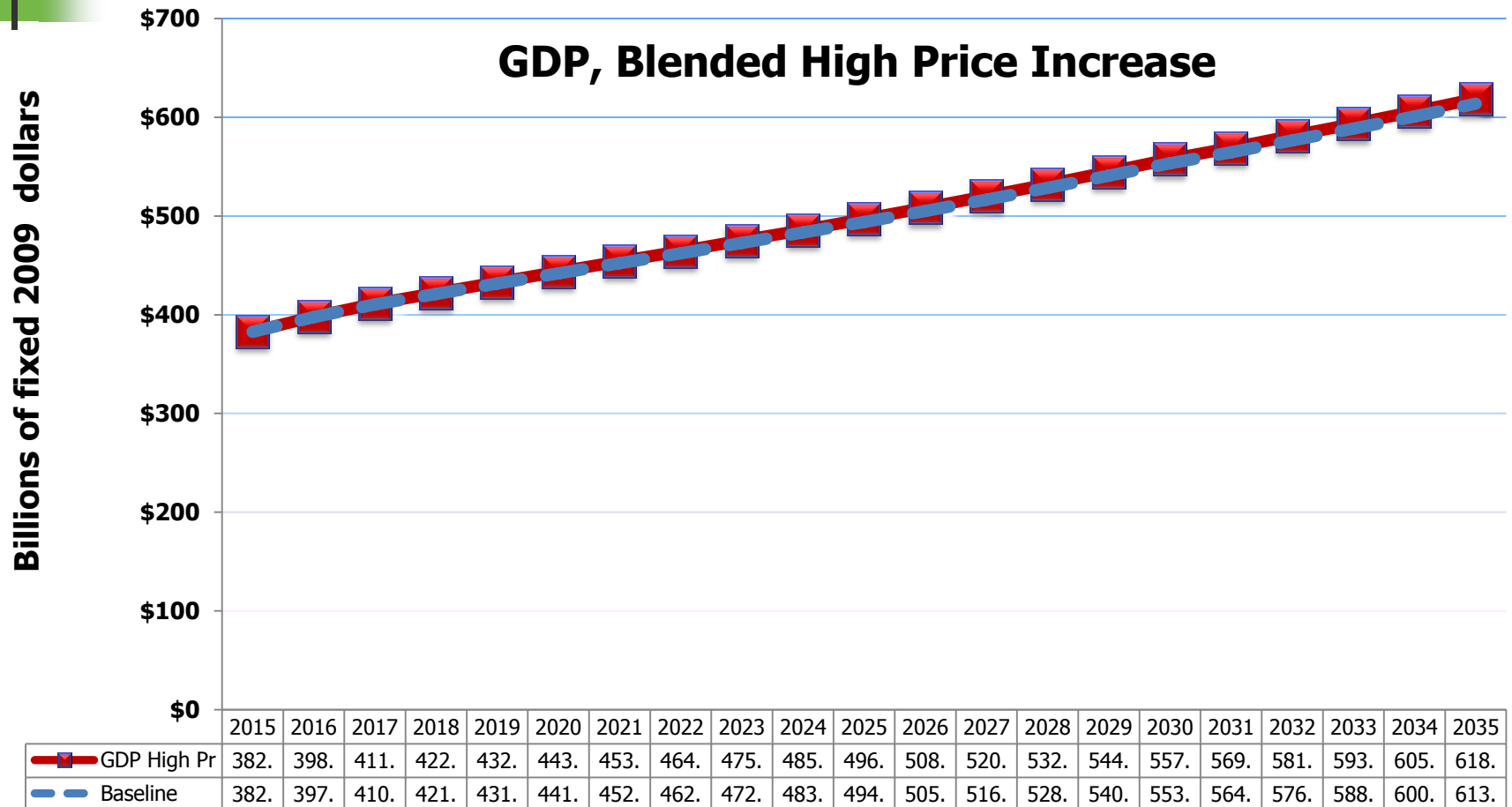
Washington Employment: Blended Allocation High Price Increase



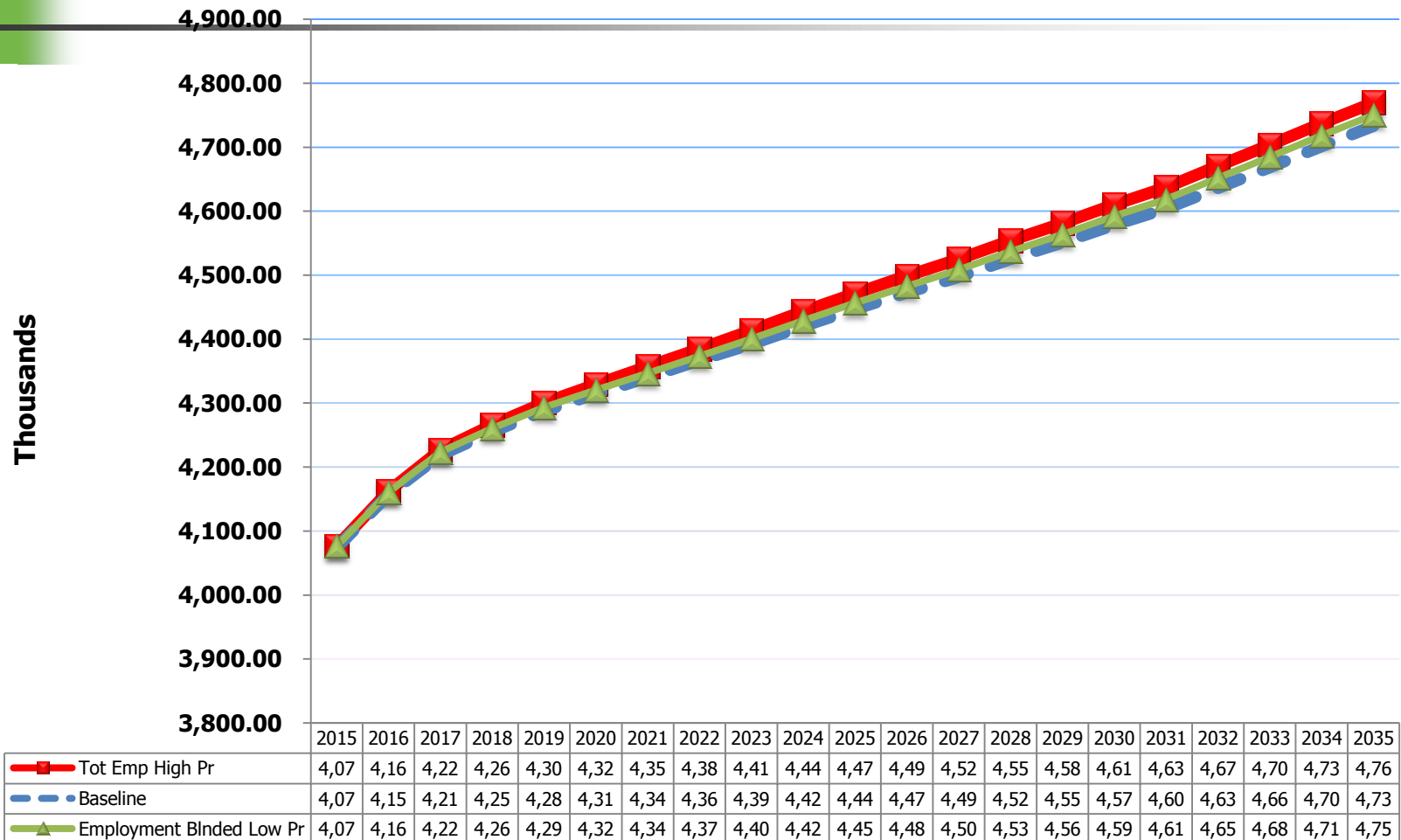
Washington Nominal Personal Income: Blended Allocation High Price Increase



Washington Real GDP: Blended Allocation High Price Increase

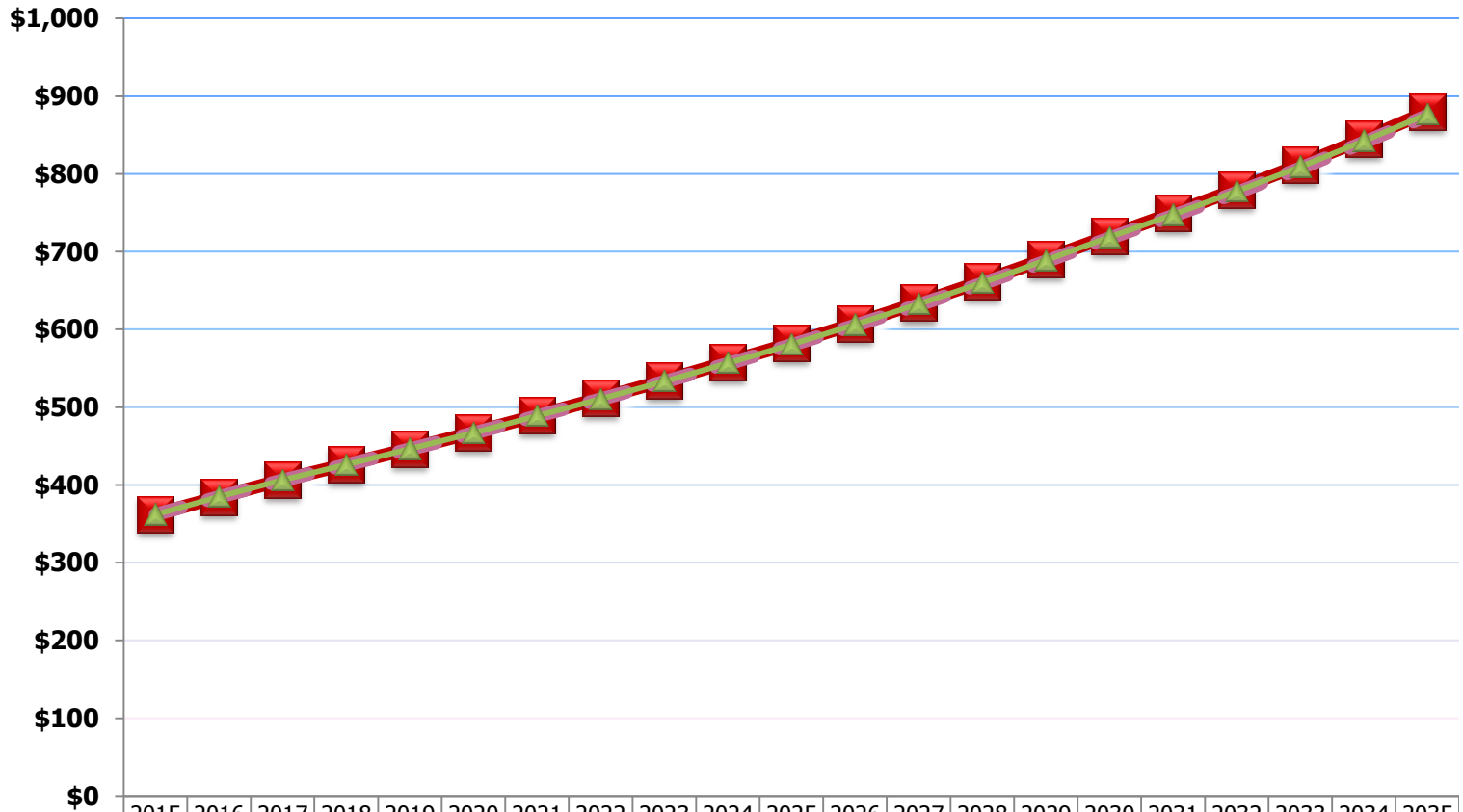


Washington Employment: Blended Allocation High & Low Price Increase vs Baseline



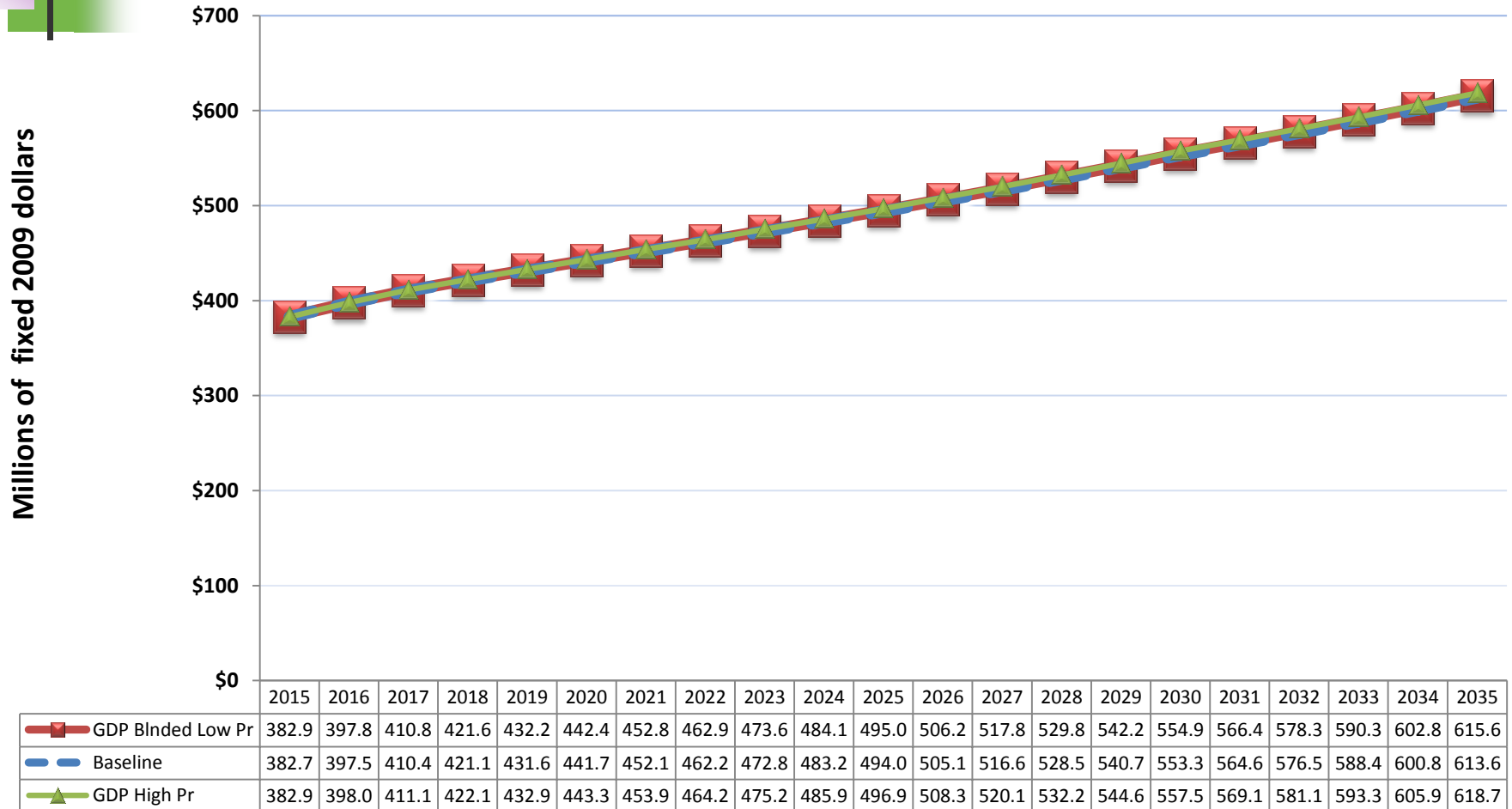
Washington Nominal Personal Income: Blended Allocation High & Low Price Increase vs Baseline

Billions of current dollars

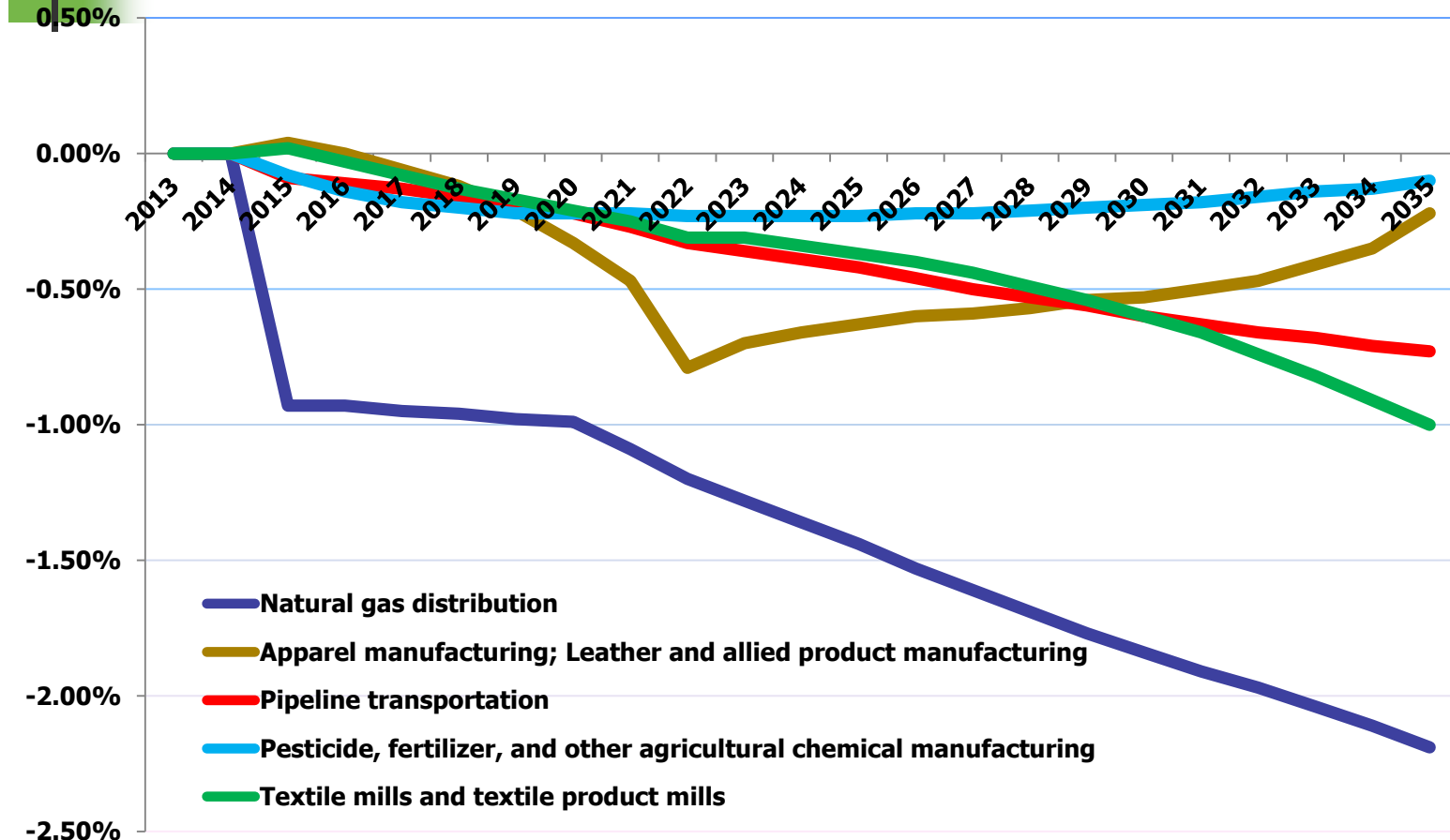


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
■ Pers Inc Hgh Pr	362.0	384.8	406.3	426.3	446.6	467.4	489.3	511.3	534.2	557.7	581.9	607.4	634.1	661.8	690.7	720.5	749.6	779.8	811.5	845.0	879.6
◆ Baseline	361.9	384.6	405.9	425.7	445.8	466.4	488.1	510.0	532.5	555.8	579.7	605.0	631.4	658.9	687.5	716.9	745.8	775.7	807.1	840.4	874.7
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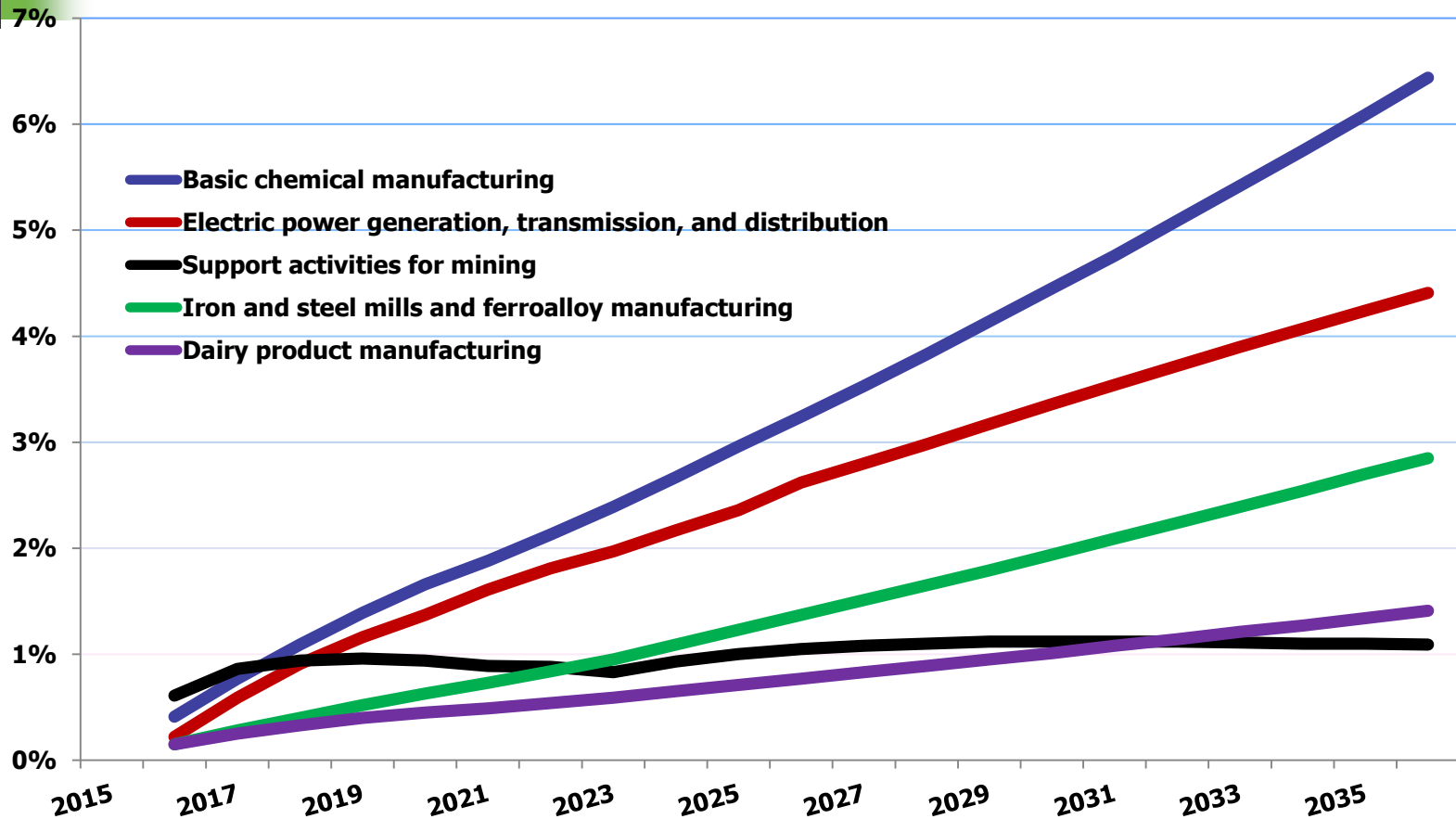
Washington Real GDP: Blended Allocation High & Low Price Increase vs Baseline



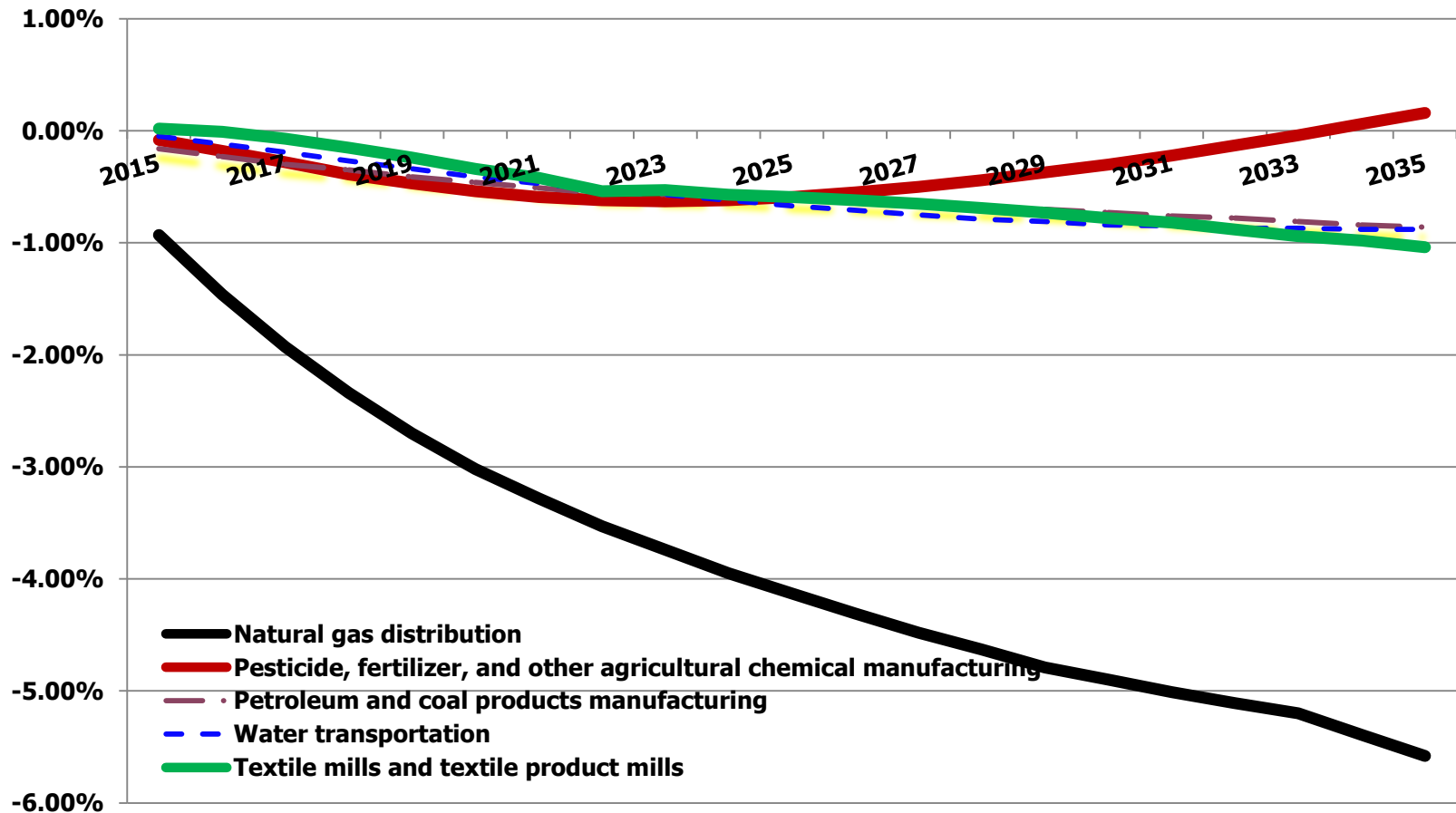
Example Model- Bottom Five Washington Industries Losing Jobs: Low Price Case



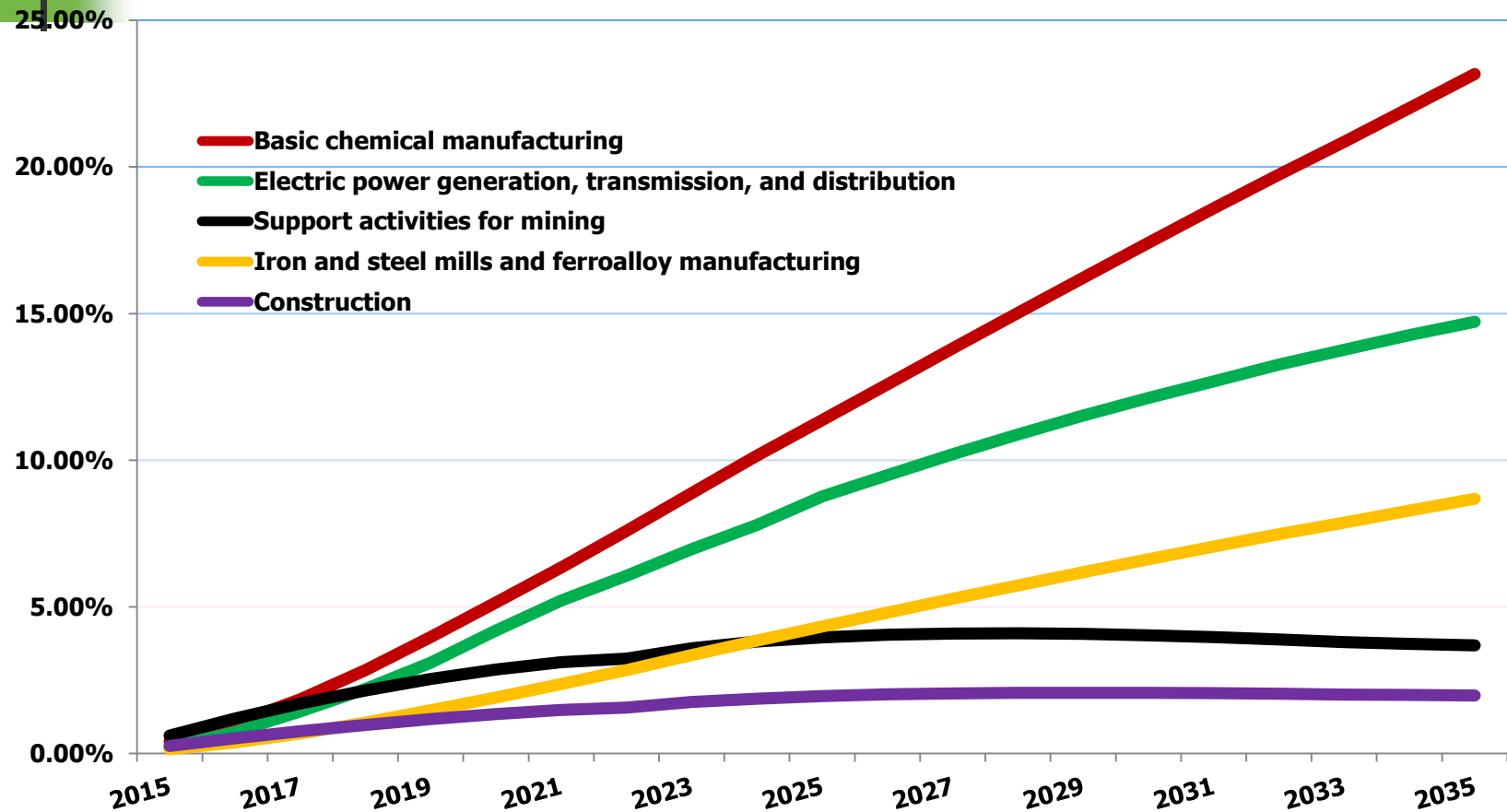
Example model- Top Five Washington Industries Gaining Jobs: Low Price Case



Example Model- Bottom Five Washington Industries Losing Jobs: High Price Case



Example Model – Top Five Washington Industries Gaining Jobs: High Price Case





Wrap up

- Statewide economic effects on Washington's jobs, GDP and personal income are small.
- Results vary at the industries level.
- Fuel and Energy Prices increase but at different rates; natural gas the most, electricity increasing at the slowest rate.
- Under the low price scenario we do not hit either the 2020 or 2035 emissions reduction limits.
- Under the high price scenario we hit both limits because the carbon price was chosen so that the limits were met.